

Highlights: Scientific Review of Findings Regarding Respiratory Diseases

Smoking causes chronic obstructive pulmonary disease (COPD). COPD is any of several pulmonary diseases, such as emphysema and chronic bronchitis, that is characterized by chronic, typically irreversible airway obstruction and that results in respiratory abnormalities. COPD, which is a rising cause of morbidity and mortality in the United States, has no cure. Lung injury from tobacco smoke leads to the development of COPD.

Damage to the Lungs

Within the lungs, small tubes the thickness of a human hair—bronchioles—end in tiny air sacs called alveoli. Oxygen moves to the blood through capillaries that line the alveolar walls. The poisons in tobacco smoke irritate tender tissue in the bronchioles and alveoli and damage the lining of the lungs. Chronic inflammation from smoking leaves the lining of the lungs scarred.

Elastin is an important protein found in lung tissue that is essential to maintaining the lung's elasticity and ventilatory function. Smoking can cause irreversible damage to elastin—damage that significantly reduces the lung's ability to exchange air efficiently.

Proteases are enzymes that break down proteins, and antiproteases are substances that inhibit protein breakdown. Genetic mutations resulting from smoking unfavorably tip the protease-antiprotease balance in the lungs toward protease, leading to tissue damage and emphysema.

The human body constantly reacts with oxygen as cells produce energy. As a consequence of this activity, highly reactive molecules known as free radicals are produced. Free radicals interact with other molecules within cells. This can cause oxidative damage to proteins, membranes, and genes. Oxidative stress occurs when the available supply of the body's antioxidants is insufficient to neutralize free radicals. The result is massive cell damage that can lead to cellular mutations, tissue breakdown, and immune compromise. Increasing evidence points to oxidative stress as being involved in many of the pathogenic processes of COPD. Cigarette smoke provides an extraordinarily strong dose of free radicals to the lung, initiating processes of oxidative injury that involve multiple cell types and the entire lung.

The toxicants in cigarette smoke cause immediate damage to cells and tissue in the human body, including those all along the way to the lungs. The body employs complex processes to heal itself, but delicate lung tissue damaged by cigarette smoke is forced to repair itself in the presence of chronic inflammation resulting from continued exposure to tobacco smoke.

Other Pulmonary Damage Caused by Smoking

Cilia are tiny hair-like projections that protect the body's airways by sweeping away mucus and foreign matter such as dust particles so the lungs can remain clear. Toxicants in tobacco smoke paralyze the cilia and eventually destroy them, removing an important protection from the respiratory system.

Cigarette smoke can also trigger asthma attacks, and smokers are at increased risk of contracting pneumonia and bronchitis.

Although the lung has defense mechanisms that function to check injury by inhaled agents, these defenses are overwhelmed by the sustained inhalation of cigarette smoke. After years of exposure to cigarette smoke, lung tissue becomes scarred, loses its elasticity, and can no longer exchange air efficiently.

Highlights: Scientific Review of Findings Regarding Respiratory Disease *(continued)*

Other Pulmonary Damage Caused by Smoking *(continued)*

Smoking cessation remains the only proven strategy for reducing the pathogenic processes leading to COPD. Individuals who stop smoking experience improved lung function, increased levels of oxygen in the body, and reduced risk for pulmonary disease over those who continue to smoke.

Disclaimer: Data and findings provided on this page reflect the content of the 2010 Surgeon General's Report (*How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General*). More recent information may exist elsewhere on the Smoking & Tobacco Use Web site (for example, in fact sheets, frequently asked questions, or other materials that are reviewed on a regular basis and updated accordingly).